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TECHNICAL DOCUMENTATION IN THE SOVIET SHIPBUILDING INDUSTRY

- USSR -

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REQUIREMENTS IN RESPECT TO TECHNICAL DOCUMENTATION

- USSR -

Following is a translation of an article by Engineer S. A. Laskin in Sudostroyeniye (Shipbuilding), No. 1, Leningrad 1960, pages 52-54/

In developing technical documentation, planning organizations often fail to take into account the requirements which shipyards now specify in respect to working drawings.

As a result complications arise in the technological processing of working drawings at shipyards and in the direct fulfillment of work which could have been avoided by more careful consideration of production requirements when developing working drawings.

The requirements of the shipyards in respect to technical documentation may be summed up, as is well known, by the following:

- a) Technical documentation should be convenient for direct work on them;
- b) Technical documentation should facilitate technological study at the shipyard and make it possible to reduce the amount of technological documentation.

Below are enumerated some concrete requirements specified by the shipyards in respect to technical documentation in regard to ship hulls.

Numbering of working drawings and sections.

The system used in numbering sections and working drawings acquires special importance in preparing sections for several plans at the same production sites at the same time.

At present the planning organizations are not of one mind on this problem. Thus, for example, the planning organizations of the MMF [Abbreviation not known, presumably Ministry of the Merchant Marine] number the sections in the sequence of their delivery to the building ways, that is the keel section is numbered No 1, the bottom section adjacent to it is No 2, et cetera. Such numbering of sections is inexpedient in case the block method of building is used or if the technology of assembly used in the building way differs from that of the planned technology. The same system of numbering of sections is essentially maintained in the planning organizations of the Ministry of the River Fleet. Other planning organizations designate the sections with three-digit numbers compiled on the basis of different numbering systems.

This diversity in numbering of sections results in inconvenience for production ways, especially in the case of individual or small series building. It is necessary to establish a unified procedure for numbering sections which will be obligatory for all planning organizations.

In our opinion, the most expedient system would be a three-digit system of numbering in which one digit would define the bloc or area

of construction, the second the part of the hull (bottom, sides, deck, et cetera), and the third the ordinal number of the section within the block, beginning with the bow, from the larboard to the starboard and from bottom up. Particular attention should be directed toward agreement of section numbers with the number given in the working drawing of this section.

At present different planning organizations number their working drawings according to different classifiers:

a) In river shipbuilding in accordance with the departmental format NRFO022--55. This format specifies that the number of each working drawing or technical document in general should include the following parts, separated by hypens: the index of the object (number of the plan); classification characteristic (number of classification group), which determines performance, functional, design, and other specifications; the ordinal number of the document within the limits of the classification characteristic (groups) and an arbitrary alphabetical designation of the document if the latter is supplementary in respect to the basic working drawing.

The classification characteristic defined by this document is numerical and consists of two digits.

b) The TsPKB-1 MMF makes use of the Razbivka sudov na konstruktivnye gruppy i stat 'i [Breakdown of Ships into Structural Groups and Articles] in determining the number of an article (the number of the classification group). According to this document, which is generally typical of all technical documentation issued by TsPKB-1 for ships of the MMF, a ship is broken down into 14 groups. Numbering of the articles is based on the designation of the groups and the ordinal number of the article in the group, based on the principle of a three-digit numerical designation of the articles in the group.

c) The classifier SI-1823--57 likewise recommends a three-digit numerical classification characteristic (number of the classification group) for working drawings.

In addition, all the documents enumerated here establish different meanings for the figures included in the classification characteristic of the number of a working drawing or other technical document.

Now, when many shipyards are filling the most varied orders for building ships, it is essential that all planning organizations be guided by a unified numbering system in issuing technical documentation.

In our opinion, "Klassifikator tekhnicheskikh dokumentov" [Classifier of Technical Documents] No SI-1823--57 should be such a unified document.

The format of the working drawings.

In recent times, when striving to decrease the number of working drawings, some design bureaus have achieved this reduction by enlarging the format and the number of sheets in the working drawing. Thus, for example, the working drawings of the side sections of one of the ships reach a length of 1500 millimeters and consist of two sheets.

It is very inconvenient to use such cumbersome working drawings when doing work under production conditions. In addition, they become worn out more rapidly.

Dimensions of 576 x 814 millimeters should be considered the maximum format for a single sheet of working drawings. However, this does not mean that increasing the number of drawings (or sheets per drawing) has been suggested, since it is possible to decrease the number by decreasing the scale or by excluding unneeded details.

Thus, for example, there is no need to outline all elements of the assembly in the general view of the section in a working drawing of a side section. It is sufficient to show the full view from the inboard side facing the DP [central longitudinal plane] since the section is assembled from above and it would be inconvenient to use working drawings in which the side section was shown from outside) schematically on a small scale (1:50 or even 1:75). Essential details should be shown in sectional views and detached drawings by explanatory notes and references to typical assemblies and standardized parts. Typical assemblies and standardized parts not only permit reducing the size of working drawings and the work of the designer, but also facilitate the technological study of the drawings at the shipyard.

Restricting the format and decreasing the scale of the working drawings certainly does not mean decreasing the size of figures and lettering and their neatness, to which, by the way, designers frequently do not pay heed even in large formats and large scale drawings.

The scheme for breaking the hull down into sections and blocks or construction areas

The scheme should be clear and detailed, including not only sections but also structural parts which are not assigned section numbers, for example: light partitions, platforms, wooden bulkheads, companionways, vestibules, portholes, masts, smokestacks, etc. (it is also desirable to give section numbers to drawings of companionways, light partitions).

The weight of the sections (without fittings) and their over-all dimensions should be given in the explanation of the scheme.

Structural parts which do not have a section number should be described in the explanation only when they are not included in a section but are installed independently in a block or are installed at the shipyard when assembling the blocks.

It is desirable that the scheme for breaking the hull down into sections coincide with the system for numbering compartments. In this case it is not obligatory to give the code for all compartments of the ship in this scheme.

When developing such joint scheme or developing these two schemes separately one must bear in mind that they are documents which will be scattered all over the shipyard both at the time of technological study of the technical documentation of the plan as well as while the ship is under construction. Therefore, they should first of all be made up in the smallest format possible. Making up the drawings in stitched sheets of No 4 format (203 x 283 millimeters) is the most convenient solution of this problem.

The scheme can be made up without maintaining the scale and with some distortion of the outlines of the hull.

It is also desirable to show control frames and control water lines on the scheme for breaking the hull down into sections which are necessary as additional theoretical bases for checking operations when assembling the hull and for coordinating fittings.

Control frames should, where possible, be located between transverse frames and floor plates at the center of the length of the sections and should be common for bottom, side, and deck sections of the given block.

Waterlines of the theoretical working drawings are selected as control water lines in such a manner that they pass along the entire length of the section as high as possible above the base line in the case of bottom sections and along the center of height for side sections.

Control cross sections, which should pass as close as possible to the edge facing the DP [central longitudinal plane] are also necessary for subsections of the upper deck which are contained in the side sections.

Scheme for testing the hull for watertightness

This scheme was developed by planning organizations in accordance with GOST [Gosudarstvennyy obshchesoyuznyy standard -- All-Union State Standard] 3285--55 or the new standard issued in 1958.

The requirements of shipyard workers in respect to a scheme for testing hulls for watertightness are as follows:

- a) The designation of sections in the testing scheme should correspond to the system for numbering compartments;
- b) The scheme should stipulate methods and standards for testing the first ship produced in series production;
- c) The scheme should stipulate the possibility of testing this or that section or compartment by the method (prescribed by GOST 3285--55 or the standard) most expedient for the given local conditions.

Working drawings of foundations

It is now necessary to examine the problem of the composition of drawings of foundations. One drawing can include several foundations only if all of them are installed in one section or in one compartment (the latter refers to those foundations and platforms which cannot be installed in sections).

Using one drawing to show several foundations to be installed in different sections at different stages of construction cannot be justified since this complicates technological study and makes it necessary to increase the number of copies of the drawing.

It is essential that all foundations included in one section or in one compartment should be shown in a minimum number of drawings, that is each working drawing of this sort should include the maximum number of foundations and platforms to be installed in one section or in one compartment. The specifications of such drawings should contain a clear separation of parts for each foundation (maintaining the ordinal numbering of parts), the name of the foundation and the calculated weight of each foundation separately. Platforms (strengthening elements under foundations) should be included in drawings of the sections.

Installation of foundations must be coordinated by elements of the hull and only in case of extreme necessity by theoretical bases.

References to the section number or the compartment number should be stamped on working drawings of foundations and also in the main journals (lists of working drawings).

The technological study of working drawings of foundations is simplified by breaking the foundations down into assemblies and subassemblies with consistent numbering of assemblies, both in the specifications (parts and weight lists) and in the working drawing.

The record of protective coating of sections and foundations This report should be issued simultaneously with working drawings of sections and foundations. It should include the protective coating, the area and region of coating with this or that coating and the quantity of necessary materials.

In addition, the report should have the following columns to be filled in at the shipyard: the number of the kit, the class of work, the method for putting on the coating; the time norm; and remarks. This permits combining the technical and the technological plans in a single document.

This report should reflect the latest achievements in the field of temporary protection of clean surfaces from corrosion (the use of new protective coatings, passivating, et cetera).

Working drawings of sections

Since working drawings of sections constitute the bulk of work on hull drawings, they should be given special attention in the development of technical documentation.

The requirements of the shipyards, in addition to what has been stated previously, are essentially the following:

1. Combining two or several sections in one working drawing is expedient only if all these sections will be assembled on one bed and if this will not cause increasing the size of the format and the number of sheets in the working drawing. Otherwise the combination of two or several sections in one working drawing is not expedient.

2. When developing the specifications (parts and weight list) of a working drawing which combines two or several sections, the parts must be listed by sections. In this case, it is desirable to limit the ordeal numbers of parts for each section within definite bounds, leaving several numbers in reserve for use as supplements.

Parts which can be put together (assembled and welded) prior to installation in a section must be combined in assemblies in the specifications; each assembly is given its number and these numbers are shown in the working drawings.

3. Parts which are scattered through a section, also parts and assemblies to be installed in the last stages of construction (in a block, or on the building way) should be specially separated in the specifications.

4. Isolation of parts and assemblies to be installed in the late stages of hull construction in independent drawings would make it possible to organize the assembly of these assemblies independently, apart from the sections, and would simplify making up parts kits for them.

5. It is essential to standardize hull parts to the maximum extent. Standardize not only the gusset plates and recesses, but also stringers, plates, assemblies, et cetera, which are repeated in drawings of sections.

6. Arc welding should be indicated in working drawings of sections.

Working drawings of fittings for sections and compartments

As a rule these working drawings are issued by the planning organizations after much delay or are not issued at all (at a time when they are absolutely essential to shipyards in series shipbuilding).

Working drawings of fittings for sections and compartments should include all fittings (both those which are welded on and those which are demountable) and which should be installed in sections or in compartments. At the same time, one should observe the principle of transferring as much of this work as possible to a shop for section fittings.

It is bad practice to install in sections fittings which are closer than 300 millimeters from the assembly edges of a section or between the assembly edge and an element of a section, or cumbersome or delicate fittings which could be damaged during transportation of the section.

It is necessary to coordinate fittings with elements of the sections and only in cases of extreme need with theoretical bases. In addition to the DP, the base line, and the plane of the middle frame, the following can be used as theoretical bases: control frames, control water lines, and control transverse sections [BATOKS], which can be specified and shown in the scheme for breaking the hull down into sections, as was stated previously.

Working drawings of fittings for sections and compartments should be developed in close contact with shipyard representatives since it is necessary to take into account requirements connected with local conditions (machinery available at the shipyard and the prevailing technological processes for shipbuilding).

The design bureaus of the shipyards should participate actively in issuing working drawings for fittings.

The requirements of shipyards in respect to technical documentation enumerated here should be taken into consideration by planning organizations when developing working drawings. These requirements should be defined precisely in accordance with the peculiarities of each shipyard.

REQUIREMENTS IN RESPECT TO TECHNICAL DOCUMENTATION ON SHIP HULLS

[Following is a translation of an article by Engineer A. M. Piskunov in Sudostroyeniye (Shipbuilding), No. 1, Leningrad, 1960, pages 55-56.]

Working drawings constitute the principal technical documentation issued by design bureaus. At present, there are two schools of thought in regard to methods for developing them. Some bureaus proceed by consolidating a drawing, combining a whole series of similar sections which are to go into one construction area (region) on one sheet. This is a new trend which permits markedly decreasing the amount of documentation issued along with a more full representation of design and assembly elements. However, this does not mean that in some cases drawings for individual sections cannot be more convenient for complicated sections.

The proposition of issuing working drawings for each section makes it possible to increase the total number of working drawings, which is more expedient for sectional assembly. This advantage of the second school of thought, however, does not have to be an obstacle to the introduction of consolidated working drawings and the number of copies to be used on the spot can be increased for convenience in sectional assembly. The use of consolidated drawings is most effective for uniform structural elements of the middle part of ships, namely: the side, deck, and also bottom plating of tanker ships.

The variety of scales and dimensions of drawings in use should also be mentioned. The basic scales for representing hull sections in a consolidated working drawing should be 1:100 or 1:50 (depending on the dimensions of the sections and the number of these sections in the construction area) which will ensure normal dimensions for the working drawings. Nevertheless, one encounters working drawings on which one or two sections are shown on a scale of 1:25. These working drawings, which possess little clearness, are too large to be laid out on ordinary tables, which complicates their use on the work sites.

The shortcomings noted here, which have given rise to a number of complaints addressed to the design bureaus, are present in the working drawings of the large refrigerator trawler, many of whose working drawings have a length of about 2 meters.

It is desirable that working drawings for installing portholes or pillars should be issued in consolidated form, according to construction areas or for the ship as a whole. Including them in the drawings of individual sections gives rise to inconveniences when installing these items and does not give any clear idea of their distribution through the ship as a whole.

The problem of setting up specifications should also be discussed. In addition to being simple, lists of parts which determine the weight and the components sections, specifications should also conform to the requirements of the technological process. At present the planning organizations, which are guided by the rules of Point 61 of the requirements in respect

to developing working drawings in conformity with the standards of C1-1822 -- 57, are not occupied with the technological study of specifications. The latter are issued in the form of separate journals with simple lists of parts. Nevertheless, it is desirable that parts which are installed in a scattered manner and also those which are assembled first in assemblies would be separated in the specifications. This would permit parallel study of working drawings and the output of technological documentation in hull shops, which in turn would facilitate preparation for and organization of production. The practice of generalizing specifications by using the tables contained in technological rate-setting charts, which is departmental (shop) documentation, should be considered inexpedient. Experience has shown that such specifications are not used in the majority of cases as they should be used and merely lead to complications when doing work.

The system for numbering working drawings should be easy to remember and should define structural elements precisely. In addition to giving the number of the plan, the designation on the working drawing should contain the number of the structural element, the number of the construction area (region) and the number of the working drawing, and the section number should be included in the case of drawings issued for each section.

For example, the number "517-112. 14-02" on a working drawing consists of the number of the plan (517), the number of the structural element (112), and the designation and section number (14-02).

The practice of developing journals of standard assemblies in accordance with the standards of C1-1822 -- 57 cannot be considered favorably since the work on the drawings is greatly complicated in this case. The working drawing is turned into a scheme and does not provide necessary information for fulfilling the assignment. For example, the plan for the aforementioned refrigerator trawler contains more than 80 such standard assemblies.

In order to lighten the work at the shipyard and in the design bureau it is essential to indicate the designations of only those assemblies stipulated by the shipbuilding standards. All other assemblies developed should be shown directly on each working drawing. The journals of such assemblies, which are essential to coordinate the work of the designers, should not go beyond the bounds of the planning organizations.

It is essential to increase the responsibility of the design bureaus in respect to indicating welded seams, namely: to increase the precision of the designations, to indicate the side for welding (particularly for light structurals), and to use progressive means for separating edges.

It is always necessary to indicate the working drawings of adjacent structural elements on each working drawing.

The numbers of the other drawings, the dimensions, and the weight of the sections should be indicated on working drawings which divide the hull into sections, along with the numbers of the sections. The four-digit number is the most acceptable designation for sections since it permits defining the structural element, the number of the construction area (region), and the ordinal number of the section. For example: 2501 and 01. Line 2 is the center.

and 2502, where 2 is the consolidated designation of the side sections; 5 is the fifth construction area (region); 01 is the first starboard section; and 02 is the first larboard section. It is expedient to issue diagrams for railings and bulkheads for individual decks and platforms, indicating their boundaries, and the numbers of the sections and working drawings. These diagrams should also contain all foundations installed in a given tweedecks space (indicating which of them are to be placed in lower and ceiling positions).

It would be desirable to have this whole complex of information on the hull and the foundations issued in the form of small pamphlets with board covers convenient for carrying in pockets. There should be enough of them to supply all workers connected with this work.

The development of lists of foundations by compartments, which are essential for checking the presence of foundations when the compartments are turned over, should be considered obligatory.

The lists of working drawings for hulls which are not compiled by articles connected with individual hull structural elements, not construction areas and which are issued by certain design bureaus are very inconvenient to use. In compiling these lists and also when designating sections it is more expedient and convenient to take construction areas as the bases rather than articles of the hull.

The existing variety in systems of designating working drawings and sections, in forms of specifications, in lists of working drawings, and also in the forms and content of other documentation on hulls leads to excessive loss of time, particularly when building a single ship with several plans.

The problem of issuing working drawings for metal work on fittings merits special attention. It is well known that installing fittings in hull sections while the sections are being assembled is more expedient from the standpoint of expenditures of labor than installing them in the building ways. However metal fittings are frequently installed in sections in the building ways due to numerous corrections and improvements on the working drawings and also in connection with lags in work on shipboard machinery as compared with work on the hulls due to late receipt of working drawings (after construction has started). Therefore, the question of metal fittings should be decided while developing the working drawings, depending upon the shipbuilding techniques specified in the plan. Since corrections and improvements of working drawings and, in particular, working drawings of metal fittings are encountered not only in the first ships of a series, but also in later ships, it will be economically expedient to include metal fittings for the hull with the drawings for installation of machinery and systems. This permits their installation along with the installation of systems. In this case, instances of lack of coordination can be corrected much more rapidly. In series and large series production of ships, it is more expedient to include the metal fittings in special working drawings devoted to metal hull fittings. In this case markings off for installation of metal fittings in the first ship of a series should

be done as a rule by a complex team of markers while the hull is being assembled on the building ways. Here the final correction and improvement of working drawings can be done for the first two ships of a series. Then the fittings can be installed when assembling the sections.

The favorable experience gained in developing the hull documentation and working drawings, also the working drawings for metal fittings for a dry cargo vessel of the Dneproges type with a cargo capacity of 5,000 tons should be noted.

It is essential to check and confirm lists of the necessary hull documentation and the form and the content of these documents, directing particular attention to developing working drawings.

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